

ABSTRACT

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Low-Loss Inductive Couplers for use in Wired Pipe Strings

A first flux-loop inductive coupler element electrically couples with a second flux-loop inductive coupler element. The first flux-loop inductive coupler element comprises a first ring-like core having high magnetic permeability and a conical-section annular first face transverse to the plane of the first core. The first face has a first annular groove separating a first conical-section larger-diameter face and a first conical-section smaller-diameter face. A first coil is wound within the annular groove. The first and second cores form a low-reluctance closed magnetic path around the first coil and a second coil of the second flux-loop inductive coupler element.

A first current-loop inductive coupler element electrically couples with a second current-loop inductive coupler element. The first current-loop inductive coupler element has a first high-conductivity, low-permeability shaped belt of a first end of a first pipe joint, a first ring-like core located at the first end, and a first electrically conductive coil wound about the first ring-like core. The first high-conductivity, low-permeability shaped belt partially encloses the first coil. It is shaped to cooperate with the second high-conductivity, low-permeability shaped belt of an adjacent second pipe joint having a second electrically conductive coil and a second high-conductivity, low-permeability shaped belt to create a closed toroidal electrical conducting path. The closed toroidal electrical conducting path encloses the first coil and the second coil when the first and second pipe joints are mated.